

**Amendments to the Claims:**

This listing of claims will replace all prior versions, and listings, of claims in the application:

**Listing of Claims:**

1. (currently amended): A method of simultaneously transmitting signals over a channel between a first device having N plurality of antennas and a second device having M plurality of antennas, the method comprising:

processing a vector  $\mathbf{s}$  representing L signals  $[s_1 \dots s_L]$  with a transmit matrix  $\mathbf{A}$  that is computed to maximize capacity of the channel by multiplying the vector  $\mathbf{s}$  with the transmit matrix  $\mathbf{A}$ , wherein the transmit matrix  $\mathbf{A}$  is equal to  $\mathbf{V}\mathbf{D}$ , where  $\mathbf{V}$  is an eigenvector matrix for  $\mathbf{H}^H\mathbf{H}$ ,  $\mathbf{H}$  is the channel response from the first device to the second device,  $\mathbf{D} = \text{diag}(d_1, \dots, d_L)$  and  $|d_p|^2$  is the transmit power for  $p = 1$  to  $L$ ; and

transmitting with a power constraint for each individual transmit antenna path, wherein if  $N \leq M$ , then  $\mathbf{D} = \mathbf{I} \cdot \sqrt{P_{\max}/N}$ , with  $\mathbf{I}$  as an identity matrix, such that the power transmitted by each of the N plurality of antennas is the same and equal to  $P_{\max}/N$ ; and if  $N > M$ , then  $\mathbf{D} = \sqrt{d \cdot P_{\max}/N} \cdot \mathbf{I}$ , such that the power transmitted by antenna i for  $i = 1$  to  $N$  is  $(d \cdot P_{\max}/N) \cdot (\mathbf{V}\mathbf{V}^H)_{ii}$ , and  $d_p = d$  for  $p = 1$  to  $L$ .

2. (currently amended): The method of claim 1, wherein the transmit matrix  $\mathbf{A}$  is computed subject to the  $[[a]]$  power constraint.

Claims 3-7. (canceled)

8. (currently amended): The method of claim 1 [[7]], wherein if  $N > M$ , then  
 $d = 1/z$  and  $z = \max_i \{(\mathbf{V}\mathbf{V}^H)_{ii}\}$ , such that the maximum power from any of the  $N$   
plurality of antennas is  $P_{\max}/N$  and the total power emitted from the  $N$  plurality of  
antennas combined is between  $P_{\max}/M$  and  $P_{\max}$ .

9. (currently amended): The method of claim 1 [[7]], wherein if  $N > M$ , then  
 $d = 1$ , such that the power emitted by antenna  $i$  for  $i = 1$  to  $N$  is  $(P_{\max}/N) \cdot (\mathbf{V}\mathbf{V}^H)_{ii}$ ,  
and the total power emitted from the  $N$  plurality of antennas combined is  $P_{\max}/M$ .

10. (previously presented): The method of claim 1, and further comprising:  
receiving at the  $M$  plurality of antennas signals transmitted by the first  
device; and

processing the signals received at each of the plurality of  $M$  antennas with  
receive weights and combining the resulting signals to recover the  $L$  signals.

11. (previously presented): The method of claim 1, wherein each of the  $L$   
signals is baseband modulated using a multi-carrier modulation process, and  
wherein the processing comprises multiplying the vector  $\mathbf{s}$  with a transmit matrix  
 $\mathbf{A}(k)$  at each of a plurality of sub-carriers  $k$ .

12. (currently amended): A radio communication device for simultaneously  
transmitting signals over a channel between  $N$  transmit antennas and  $M$  receive  
antennas, the radio communication device comprising:

- a.  $N$  plurality of antennas;
- b.  $N$  plurality of radio transmitters each coupled to a corresponding one  
of the plurality of antennas; and

c. a baseband signal processor coupled to the N plurality of radio transmitters to process a vector  $\mathbf{s}$  representing L signals  $[s_1 \dots s_L]$  with a transmit matrix  $\mathbf{A}$  that is computed to maximize capacity of the channel by multiplying the vector  $\mathbf{s}$  with the transmit matrix  $\mathbf{A}$ , wherein the transmit matrix  $\mathbf{A}$  is equal to  $\mathbf{V}\mathbf{D}$ , where  $\mathbf{V}$  is an eigenvector matrix for  $\mathbf{H}^H\mathbf{H}$ ,  $\mathbf{H}$  is the channel response from the first device to the second device,  $\mathbf{D} = \text{diag}(d_1, \dots, d_L)$  and  $|d_p|^2$  is the transmit power for  $p = 1$  to  $L$ ; and to transmit according to a power constraint for each individual transmit antenna path, wherein if  $N \leq M$ , then  $\mathbf{D} = \mathbf{I} \cdot \sqrt{P_{\max}/N}$ , with  $\mathbf{I}$  as an identity matrix, such that the power transmitted by each of the N plurality of antennas is the same and equal to  $P_{\max}/N$ ; and if  $N > M$ , then  $\mathbf{D} = \sqrt{d \cdot P_{\max}/N} \cdot \mathbf{I}$ , such that the power transmitted by antenna  $i$  for  $i = 1$  to  $N$  is  $(d \cdot P_{\max}/N) \cdot (\mathbf{V}\mathbf{V}^H)_{ii}$ , and  $d_p = d$  for  $p = 1$  to  $L$ .

13. (currently amended): The device of claim 12, wherein the transmit matrix  $\mathbf{A}$  is computed subject to the  $[[a]]$  power constraint.

Claims 14-18 (canceled)

19. (currently amended): The device of claim 12  $[[18]]$ , wherein if  $N > M$ , then  $d = 1/z$  and  $z = \max_i \{(\mathbf{V}\mathbf{V}^H)_{ii}\}$  such that the maximum power from any antenna of the N plurality of antennas is  $P_{\max}/N$  and the total power emitted from the N plurality of antennas combined is between  $P_{\max}/M$  and  $P_{\max}$ .

20. (currently amended): The device of claim 18, 12  $[[18]]$ , wherein if  $N > M$ , then  $d = 1$ , such that the power emitted by antenna  $i$  for  $i = 1$  to  $N$  is  $(P_{\max}/N) \cdot (\mathbf{V}\mathbf{V}^H)_{ii}$ , and the total power emitted from the N plurality of antennas combined is  $P_{\max}/M$ .

21. (original): The device of claim 12, wherein each of the  $L$  signals is baseband modulated using a multi-carrier modulation process, and the baseband signal processor multiplies the vector  $\mathbf{s}$  with a transmit matrix  $\mathbf{A}(k)$  at each of a plurality of sub-carriers  $k$ .

22. (currently amended): A radio communication system for simultaneously transmitting signals over a channel between  $N$  transmit antennas and  $M$  receive antennas, the radio communication system comprising:

a. a first device comprising:

i.  $N$  plurality of antennas;

ii.  $N$  plurality of radio transmitters each coupled to a corresponding one of the plurality of antennas; and

iii. a baseband signal processor coupled to the  $N$  plurality of radio transmitters to process a vector  $\mathbf{s}$  representing  $L$  signals  $[s_1 \dots s_L]$  with a transmit matrix  $\mathbf{A}$  that is computed to maximize capacity of the channel by multiplying the vector  $\mathbf{s}$  with the transmit matrix  $\mathbf{A}$ , wherein the transmit matrix  $\mathbf{A}$  is equal to  $\mathbf{V}\mathbf{D}$ , where  $\mathbf{V}$  is an eigenvector matrix for  $\mathbf{H}^H\mathbf{H}$ ,  $\mathbf{H}$  is the channel response from the first device to the second device,  $\mathbf{D} = \text{diag}(d_1, \dots, d_L)$  and  $|d_p|^2$  is the transmit power for  $p = 1$  to  $L$ ; and to transmit according to a power constraint for each individual transmit antenna path, wherein if  $N \leq M$ , then  $\mathbf{D} = \mathbf{I} \cdot \text{sqrt}(P_{\max}/N)$ , with  $\mathbf{I}$  as an identity matrix, such that the power transmitted by each of the  $N$  plurality of antennas is the same and equal to  $P_{\max}/N$ ; and if  $N > M$ , then  $\mathbf{D} = \text{sqrt}(d \cdot P_{\max}/N) \cdot \mathbf{I}$ , such that the power transmitted by antenna  $i$  for  $i = 1$  to  $N$  is  $(d \cdot P_{\max}/N) \cdot (\mathbf{V}\mathbf{V}^H)_{ii}$ , and  $d_p = d$  for  $p = 1$  to  $L$ .

b. the second device comprising:

i.  $M$  plurality of antennas;

ii.  $M$  plurality of radio receivers each coupled to a corresponding one of the plurality of antennas; and

iii. a baseband signal processor coupled to the  $\underline{M}$  [[N]] plurality of radio receivers to process signals output by the plurality of radio receivers with receive weights and combining the resulting signals to recover the L signals  $[s_1 \dots s_L]$ .

Claims 23-26. (canceled)

27. (new): The system of claim 22, wherein if  $N > M$ , then  $d = 1/z$  and  $z = \max_i \{(\mathbf{V}\mathbf{V}^H)_{ii}\}$  such that the maximum power from any antenna of the N plurality of antennas is  $P_{\max}/N$  and the total power emitted from the N plurality of antennas combined is between  $P_{\max}/M$  and  $P_{\max}$ .

28. (new): The system of claim 22, wherein if  $N > M$ , then  $d = 1$ , such that the power emitted by antenna i for  $i = 1$  to N is  $(P_{\max}/N) \cdot (\mathbf{V}\mathbf{V}^H)_{ii}$ , and the total power emitted from the N plurality of antennas combined is  $P_{\max}/M$ .

29. (new): The system of claim 22, wherein each of the L signals is baseband modulated using a multi-carrier modulation process, and the baseband signal processor multiplies the vector  $\mathbf{s}$  with a transmit matrix  $\mathbf{A}(k)$  at each of a plurality of sub-carriers k.